APPENDIX B: BOAT WASHING TREATMENT SYSTEM DESIGN

The submerged portion of the hull of marine vessels is coated with an anti-foulant paint which is toxic to marine organisms. The paint contains copper and other pesticide ingredients to prevent shellfish and algae from growing on the underwater areas of boats or other marine structures. Designed to continuously deliver these toxic ingredients into the water, significant amount of the paint can also be released to the environment when the underside of boats are pressure washed if the wash water is freely infiltrating into the ground surface or running-off into natural buffers. This activity will concentrate particles of copper and other heavy metals in the ground in the vicinity of the washing area.

This appendix describes a small collection and treatment system for boat washwater to demonstrate that washwater treatment can be managed effectively, simply, and in a cost-effective manner. This technology would promote washwater treatment at boatyards and marinas in Maine without the need for regulations. The Department of Environmental Protection will oversee the demonstration project.

The treatment plant will contain the water, and settle the larger paint particles and marine sediments (i.e., seaweed, shells and sand) in a sump. The water will then be processed for the removal of finer particles by filtration through a manufactured filter system which will strip the water to meet ambient water quality criteria (AWQC), allowing it to be discharged in a stormwater drainage ditch or into an infiltration system. The washwater could also be discharged into the local stormwater system, if available.

Ideally, the treatment system will be fully passive (i.e., with no mixing of chemicals or pumping components), and if the site layout permits, with gravity water flow. This will have to be determined based on site elevations. The cost associated with a passive treatment system will be minimal. With a pumped system, costs will be only slightly more.

The alternative to this simple passive filtering device is a mechanical wastewater treatment system (e.g., Novachem "Flow Through Clarifier" or Alikota water recycling system). The concern with such systems is the cost – approximately $10,000 or more. When a marina or boatyard is operating only 4 to 5 months of the year, or washes only a dozen or so boats every year, this kind of investment is not justifiable.

PROPOSED CONSTRUCTION DESIGN

The installation of the demonstration project will involve the construction of a bermed and paved concrete pad with a collection trough and catch basin connected to a small filtering system placed in a sump. Because boatyards and marinas in Maine do not serve a large number of boats, the disposal of the water could be directed either directly into a buffer, stormwater drainage system, or into an infiltration trench.

The lay-out of the proposed design is shown in Figure B-1.

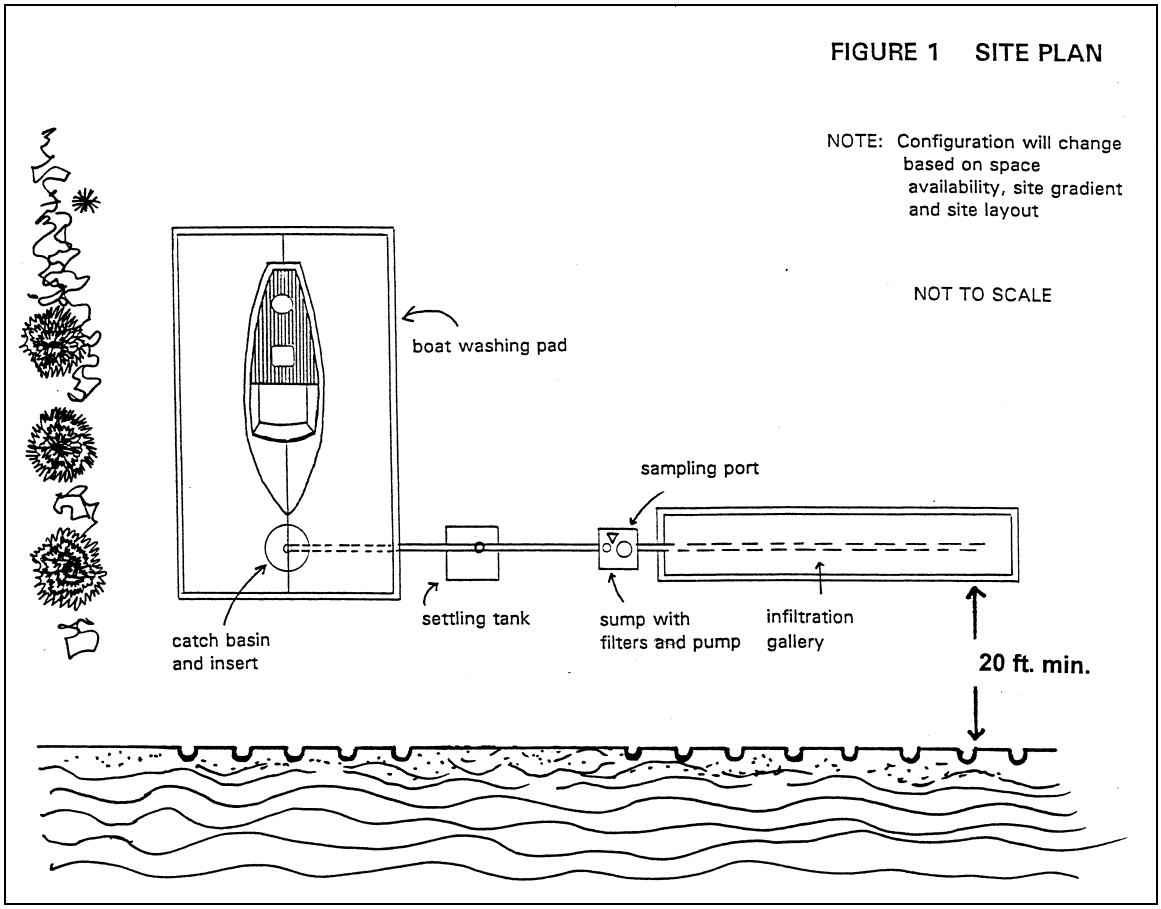

Figure B-1. DESIGN OF BOAT WASHING TREATMENT SYSTEM

1. **PAD** An impervious slab of either concrete or bituminous pavement will be built beneath the area designated for washing boat hulls. Its size will be adequate to collect all the dripping water from the largest boats. It should slope to the center a minimum of 5%, and toward a catch basin 5 to 7%. Curbing will be installed around the perimeter of the slab.

The site plan and pad design are shown in Figures B-1 and B-2.

2. **CATCH BASIN** A catch basin will be installed under a grate at the lowest point in the slab. It is designed to settle any sea shells, sand and gravel, and to filter floating marine debris. The bottom elevation of the catch basin will be a minimum of 3 feet above the highest tide for the site.

   If site gradient and elevation differential will not permit gravity water flow, a sump pump may be necessary to pressurize the water through the filtration devices. The catch basin will be cleaned, and the pump maintained, on a regular basis.

3. **SEDIMENT FILTRATION** To remove large debris and sediments from the water stream, a filter bag insert will be installed in the catch basin. An insert or bag

filter can be cost effective, disposable, easily cleaned or replaced, and works passively to remove up to 96% of total suspended solids which are 15 microns or larger.
The filter should be cleaned and/or replaced as needed during the boat washing season when it is full, or if water flow through the filters is slowed by clogging The filter contents may be able to be disposed of in a public landfill. However, the contents of the first bag during the pilot test will be analyzed to confirm which disposal method is most appropriate.

Water exiting the catch basin will be sufficiently stripped of fine sediment and metal particulates to be processed in the proposed water treatment filters.

4. **FINAL FILTRATION DEVICE** All final filtration devices are located in a sump after the catch basin. If the water cannot flow through the filters by gravity, a pump will be needed.

   Water flows first through a particulate filter to reduce turbidity in the water which otherwise could cause clogging. The proposed particulate filter is a regular household cartridge filter rated at 6 gallons per minute and with a 5 microns filtering capability.

   Final treatment of the washwater occurs in a cation exchange resin filter. The canister has a 2 cubic foot capacity and is filled with a reactive resin. Water exiting the filter should be free of metals (copper in particular) and below AWQC. The resin filter may or may not need replacement at the end of the boat washing season. For the pilot test, the resin filter will be evaluated at that time and if it needs replacing, the resin pellets will be emptied and replaced. The material removed can be disposed of in a public landfill. As part of this project, the Department will test the water initially, at the end of the season, and the following year to confirm the system's effectiveness.

DESIGN VARIATIONS

Based on site constraints, the proposed design can be altered in some respects. The following discussion anticipates some possible implementation needs.

1. **SETTLING TANK** Depending upon the volume of water used for washing, the quantity of water needing treatment, the flow capacity of the filtering devices, and the permeability of the infiltration trench, a settling tank may be needed. The tank would permit additional settling time and control the rate of water flow out of the tank and through the final filtration device. Depending on the site gradient, a pump may be needed to pressurized the water outflow and through the filtration devices. Based on the water storage needs, the size of the tank could vary between 50 gallons and 300 gallons and could be either underground or above ground.

FIGURE 2 SITE CROSS SECTION

NOTE: Configuration will change based on space availability, site gradient and site layout

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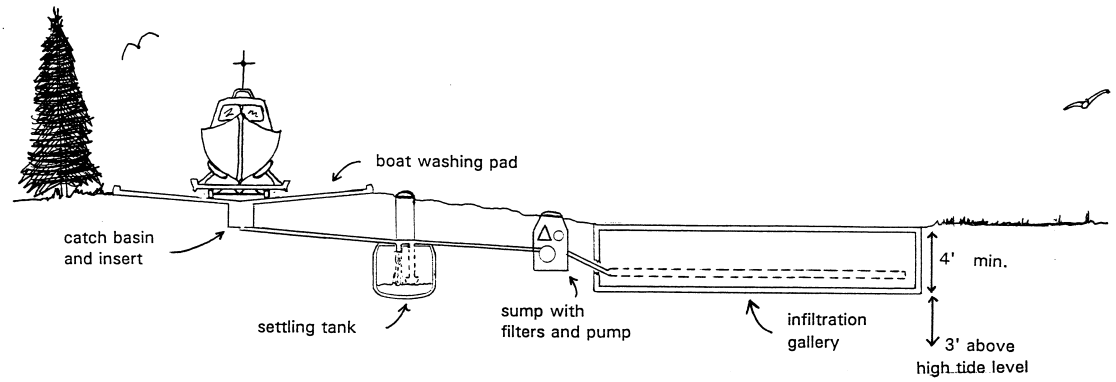

Figure B-2. CROSS SECTION OF BOAT WASHING SYSTEM

At the end of each boat washing season, the tank should be pumped out and the settlements disposed of appropriately, either through a licensed hazardous waste handler or in a licensed landfill, depending upon laboratory results for heavy metals. If a tank is needed, the Department is proposing to test the residues once as part of this project. The sediments will then be handled from then on based on these results.

2. **WATER RECYCLING** As an alternative to discharging treated water into the environment, the settlement tank proposed above could also be used as a holding tank for boat-washing water. This option would be considered if the area has bedrock near the ground surface and excavation is not practical.

   In that case, the filtration devices would be placed before the tank, either located underground or above-ground. A sump pump would need to pressurize the water from the catch basin through the filters and into the storage tank. There, another pump would be needed to pressurize the stored treated water for washing the next boat. Additional tap water would be added as needed to maintain water flow. At the end of the season, the stored water would be disposed of appropriately through a hazardous waste handler, if needed, as the water may accumulate copper through multiple reuses. Again, the Department would test the water as part of this project.

3. **INFILTRATION TRENCH** If disposal of the treated water is not feasible because either the treatment is insufficient in meeting AWQC water quality levels or because of site constraints, a small infiltration trench would be built to

percolate the treated water into the subsurface. For infiltration into the subsurface, water quality would only need to meet Drinking Water Standards which are much less stringent than Ambient Water Quality Criteria (AWQC).

The proposed trench should be, at a minimum, 10 feet long and lined with a geotextile filter fabric to a 3 foot depth. A slotted PVC pipe, 4 inches in diameter, would be installed in granular sand and extended to a depth of 1½ feet below the ground surface. The bottom elevation of the pipe should be a minimum of 3 feet above the highest tide recorded for the site. The excavated soil could be used to backfill the trench.

The trench should be placed within 10 to 20 feet of the high tide level. This distance will ensure sufficient filtration, but also make sure that the infiltrated water will never end up in a drinking water well. A good location for an infiltration bed is underneath the boat washing pad, if another emplacement is not feasible.

Final Design Selection

The final selection of the system's different component options is based on several factors:

- the level of treatment for the water discharged directly to surface waters;
- the availability of space for an infiltration trench;
- the site gradients and whether there is a sufficient change in elevation for gravity water flow;
- the soil type – if the site is on bedrock, then infiltration is not possible and the recycling approach must be considered, and the whole system will be installed above ground;
- the number of boat washings – in a small boatyard, where very few boats are washed in a year, the simpler the system, the most acceptable, implementable and cost effective it will be; and
- the availability of a water supply for washing boats and where conserving water is unnecessary.

Maintenance

Maintenance will be required to keep the treatment system fully operational and effective. The following maintenance schedule is anticipated:

Initially:

- Water samples will be obtained after the catch basin filtration device and after the resin filter. The samples will be analyzed for turbidity, pH, suspended particles size and amount, metals, and hydrocarbons.

At the end of the season:

- A water sample will be obtained after the resin filter to assess its current effectiveness. The sample will be analyzed for the same parameters as the initial testing round.

- When the resin pellets are replaced in the filter, it will be tested for metals to determine the appropriate disposal method.

- If a settling tank is used, the sediments will be sampled and tested for metals to determine the appropriate disposal method.

- If the water is recycled, it will be tested for metals to determine the appropriate disposal method.

COST ASSESSMENT

At this point, the proposed system's following costs are approximate:

Pad :	
site leveling, subbase, pavement and curb; size 20' by 50'	$3,000
Catch basin: basin	$200
piping	$100
filter inserts	$300
Settling tank:	
250 gallons plastic tank	$300
pump	$200
Excavation/installation	$500
Electrical	$1,000
Final filtration:	
sump	$200
particulate filter	$100
resin filter	$200
resin	$200
pump	$200
plumbing	$500
electrical	$1,000
infiltration trench:	
excavation/backfill	$2,000
piping/sand/filter fabric	$500

- TOTAL for basic system (pad, catchbasin and filtration): $6,000

- If an infiltration trench is needed, additional cost: $2,500.

- If a settling tank is necessary, the additional cost will be approximately $2,000.

- If a Novachem (off the shelf) system is used, the additional cost will be in excess of $10,000 to $13,000.

- Laboratory sampling will amount to approximately $500 to $1,000 the first year, none thereafter.

- Approximate maintenance cost is $100 to $200 per year for the catchbasin insert, cartridge filter and resin material.